TABLE OF CONTENTS

LIST OF ABBREVIATIONS

Ag	Agricultural
aka	also known as
AMC	Adaptive Management Committee
Avg	Average
Basin Plan	Water Quality Control Plan: Colorado River Basin – Region 7
BMP(s)	Best Management Practice(s)
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
Coef Var	Coefficient of Variance
CWC	California Water Code
DDD	Dichlorodiphenyl dichloroethane
DDE	Dichlorodiphenyl dichloroethylene
DDT	Dichlorodiphenyl trichloroethane
DWQIP	Drain Water Quality Improvement Plan
DWQMP	Drain Water Quality Monitoring Plan
EPA	United States Environmental Protection Agency
EIFAC	European Inland Fisheries Advisory Council
FDA	Food and Drug Administration
FOTG	Field Office Technical Guide
FRSH	Freshwater Replenishment
ICFB	Imperial County Farm Bureau
IID	Imperial Irrigation District
mg/L	milligram(s) per liter
MP(s)	Management Practice(s)
NAS	National Academy of Sciences
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
NRCS	Natural Resources Conservation Service
NTU	Nephelometric Turbidity Unit
OAL	Office of Administrative Law
ppb, ww	parts per billion, wet weight
QAPP	Quality Assurance Project Plan
RARE	Preservation of Rare, Threatened, or Endangered Species
REC I	Water Contact Recreation
REC II	Non-contact Water Recreation
Regional Board	Regional Water Quality Control Board, Colorado River Basin Region
RWQCB	Regional Water Quality Control Board, Colorado River Basin Region
Sed	Sediment
State Board	State Water Resources Control Board

LIST OF ABBREVIATIONS (CONTINUED)

Std Dev	Standard Deviation
TAC	Technical Advisory Committee
TMDL(s)	Total Maximum Daily Load(s)
Total DDT	The sum of DDT, DDE, and DDD
TSS	Total Suspended Solids
UCCE	University of California Cooperative Extension
USEPA	United States Environmental Protection Agency
WARM	Warm Freshwater Habitat
WDRs	Waste Discharge Requirements
WILD	Wildlife Habitat
WQMP(s)	Water Quality Management Plan(s)
WWTP(s)	Wastewater Treatment Plant(s)

This staff report uses the term "Management Practice (MP)" instead of the term "Best Management Practice (BMP)". The "Best Management Practice" term was used in previous sedimentation/ siltation TMDLs and may be used in some supporting documents for this TMDL if written prior to the term change or written by persons outside of the TMDL Development Unit.

INTRODUCTION

The Imperial Valley drains are listed as impaired on the State of California's Clean Water Act Section 303(d) List, in part, because sediment violates water quality objectives that protect beneficial uses. These beneficial uses include: warm freshwater habitat (WARM); wildlife habitat (WILD); preservation of rare, threatened, or endangered species (RARE); water contact and non-contact water recreation (REC I and REC II); and freshwater replenishment (FRSH) (California Regional Water Quality Control Board as amended to date).

Accordingly, Sedimentation/ Siltation Total Maximum Daily Loads (TMDLs) are proposed for the Imperial Valley drains, by the California Regional Water Quality Control Board, Colorado River Basin Region (Regional Board). This TMDL applies to three Imperial Valley drains (Niland 2, P, and Pumice) and their tributary drains (Vail 4A, Vail 4, Vail 3A, Vail 3, and Vail 2A feed into Pumice). These drains total 39 miles long, and are referred to in this document as "subject drains". Total suspended solids (TSS) and turbidity data indicate that the subject drains are impaired by sediment.

Imperial Valley drains are sustained and dominated by agricultural return flows discharged from Imperial Valley farmland. The subject drains serve 10,463 acres of irrigated (non-idle) land, and empty directly into the Salton Sea. Figure 1 is a map of the project area.

Figure 1: Project Area for the Imperial Valley Drains (Niland 2, P, and Pumice) Sedimentation/ Siltation TMDL

This TMDL seeks to achieve water quality objectives and protection of beneficial uses by reducing the amount of sediment. A TMDL quantifies the amount of pollutant loading that a waterbody can assimilate without violating water quality objectives. When allowable loads are achieved, they are expected to eliminate impairments.

Significant public input occurred during TMDL development, including recommendations from the Imperial Valley Sedimentation/ Siltation TMDL Technical Advisory Committee (Silt TMDL TAC) composed of private and government stakeholder groups (Appendix A). This draft TMDL will be circulated for public review before consideration of adoption by the Regional Board during a public hearing.

Adoption of this TMDL will bring more of the Imperial Valley into compliance with a uniform sedimentation/ siltation standard, as represented by a Total Maximum Daily Load numeric target. The Alamo River Sedimentation/ Siltation TMDL was adopted by the Regional Board in June 2001; approved by the State Water Quality Control Board, Office of Administrative Law (OAL) in May 2002; and approved by the U.S. Environmental Protection Agency (USEPA) in June 2002. The New River Sedimentation/ Siltation TMDL was adopted by the Regional Board in June 2002, approved by OAL in January 2003, and approved by USEPA in March 2003.

PROBLEM STATEMENT

This section includes a description of: (a) water quality objectives and beneficial uses, and (b) impairments caused by sedimentation/ siltation.

A. WATER QUALITY OBJECTIVES AND BENEFICIAL USES

Narrative water quality objectives for sediment, suspended solids, and turbidity were established by the Regional Board to protect beneficial uses of waterways in the Region. Violations of water quality objectives indicate that beneficial uses are impaired. Table 1 summarizes water quality objectives applying to all surface waters in the Region. Table 2 summarizes beneficial uses specific to Imperial Valley drains (including the subject drains).

Table 1: Water Quality Objectives for All Surface Waters in the Region

Parameter	Water Quality Objective
Sediment	The suspended sediment load and suspended sediment discharge rate to surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.
Suspended Solids	Discharges of wastes or wastewater shall not contain suspended or settleable solids in concentrations which increase the turbidity of receiving waters, unless it can be demonstrated to the satisfaction of the Regional Board that such alteration in turbidity does not adversely affect beneficial uses.
Turbidity	Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses.

(California Regional Water Quality Control Board as amended to date)

Table 2: Beneficial Uses of the Imperial Valley Drains

Beneficial Use	Description
Warm Freshwater Habitat (WARM)	Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.
Wildlife Habitat (WILD)	Uses of water that support terrestrial ecosystems including, but not limited to, the preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), water, and food sources.
Preservation of Rare, Threatened, or Endangered Species (RARE)	Uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened or endangered.
Water Contact Recreation (REC I)	Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, and use of natural hot springs. **Note:** For Imperial Valley drains, the only known REC I usage is infrequent fishing, which is unauthorized.
Non-Contact Water Recreation (REC II)	Uses of water for recreational activities involving proximity to water, but not normally involving contact with water where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tide pool and marine life study, hunting, sightseeing, or aesthetic enjoyment of the above activities. **Note:** For Imperial Valley drains, such activity is unauthorized.
Freshwater Replenishment (FRSH)	Uses of water for natural or artificial maintenance of surface water quality or quantity.

(California Regional Water Quality Control Board as amended to date)

B. IMPAIRMENT BY SEDIMENT

Sediment data, represented by total suspended solids (TSS) and turbidity, indicate that the subject drains are impaired by sediment. TSS and turbidity are at excessive levels, as in the Alamo and New Rivers. Farming practices along the two rivers and the subject drains are similar. Table 3 summarizes TSS and turbidity data (annual averages) for the subject drains. Raw data is contained in Appendix B.

Table 3: Total Suspended Solids (TSS) and Turbidity of the Subject Drains – Annual Average at the Outlet

Drain Name	TSS (mg/L*)	Turbidity (NTU**)
Niland 2	410	455
P	235	195
Pumice	610	250
All Drains	**418**	**339**

* = milligrams per liter
** = nephelometric turbidity unit

Sediment as an Impairment to Aquatic and Terrestrial Organisms
Excess sediment in the water column and in bottom deposits threatens many aquatic and terrestrial organisms that utilize Imperial Valley drain habitat, as well as habitat downstream of the drains. Diversity is reduced as sediment-sensitive species disappear.

In the water column, excess sediment can: (1) clog fish gills, causing death or inhibiting growth, (2) prevent successful development of fish eggs and larvae, (3) modify natural fish movements and migration, and (4) reduce food abundance available to fish. Excess sediment in the water column also can: (1) reduce light penetration, which reduces the ability of algae to produce food and oxygen, (2) affect other parameters such as temperature, and (3) interfere with mixing, which decreases oxygen and nutrient dispersion to deeper layers.

In bottom deposits, excess sediment can: (1) smother bottom-dwelling organisms, (2) cover breeding areas, and (3) smother eggs. Excess bottom sediment in riparian habitat can bury tree and shrub roots, as well as reeds, cattails, and arrowheads used for food and cover. Riparian areas constitute sensitive habitat, as they provide important habitat for songbirds and serve as potential wildlife movement corridors. Excess bottom sediment in wetland habitat can choke out plants that are used for food and cover, and can drastically reduce the health and numbers of organisms (e.g., plankton, detritus, aquatic vegetation) at the base of the food web. Wetland areas, as part of the Salton Sea delta, are a critical stop for migrating birds on the ecologically important Pacific Flyway, a major migratory route connecting Canada and the U.S. to Mexico and Central America.

Sediment as a Carrier for DDT, DDT Metabolites, and Toxaphene
Imperial Valley has one of the highest maximum Total DDT concentrations (in fish tissue) in the Colorado River Basin Region (Table 4) and the State of California (State Water Resources Control Board 1978-1995). Total DDT concentrations in fish tissue routinely exceed the National Academy of Sciences (NAS) recommended maximum concentration (State Water Resources Control Board 1978-1995) and the U.S. Food and Drug Administration (FDA) Action Level. (NAS guidelines are meant to protect species that consume DDT at all food chain levels. FDA Action Levels are meant to protect humans from chronic effects of DDT consumption, and are based on consumption quantity and frequency.)

Table 4: DDT in Fish Tissue -- Data by Surface Water for the Colorado River Basin Region

Station Location	Number of Samples	Number of Organisms	Number Exceeding NAS Criteria	Number Exceed-ing FDA Action Level	Maximum (ppb, ww)*	Mean (ppb, ww)	90th Percentile (ppb, ww)
Imperial Valley	116	848	41	6	9153	1251	3308
Alamo River (all stations)	27	137	21	5	9153	2816	5468
Alamo River/ International Boundary	4	56	3	0	1371	955	1305
Alamo River/ Holtville	1	3	0	0	515	515	
Alamo River/ Brawley	1	3	0	0	460	460	
Alamo River/ Calipatria	21	75	17	5	9153	3392	5517
New River (all stations)	34	176	12	0	3368	1090	2584
New River/ International Boundary	8	85	1	0	1209	539	825
New River/ Westmorland	26	91	11	0	3368	1259	2687
Agricultural Drains	30	399	9	1	5106	1087	3324
Salton Sea	21	102	0	0	276	97	180
Fig Lake	7	40	0	0	592	145	321
Wiest Lake	1	4	0	0	38	38	
Salt Creek Slough	3	6	1	0	3319	1193	
Coachella Valley Stormwater Channel	7	84	2	0	2883	1224	2695
Palo Verde Outfall Drain	9	45	1	0	1475	354	632
Colorado River (all stations)	17	90	0	0	855	102	165
Colorado River/ Needles	3	12	0	0	77	38	
Colorado River/ Pichaco	2	11	0	0	46	28	
Colorado River/ Upstream of Imperial Dam	3	21	0	0	27	15	
Colorado River/ Cibola	6	34	0	0	175	96	
Colorado River/ International Boundary	3	12	0	0	855	313	

(State Water Resources Control Board 1978-1995)

* parts per billion wet weight

DDT (Dichlorodiphenyl trichloroethane) was a widely used insecticide in the United States between 1942 and 1973. DDT breakdown products include the metabolites DDE (Dichlorodiphenyl dichloroethylene) and DDD (Dichlorodiphenyl dichloroethane). The sum of DDT, DDE, and DDD commonly are referred to as "Total DDT." DDT, DDE, and DDD are known carcinogens listed in the Governor's Proposition 65 List of Chemicals Known to the State of California to Cause Cancer or Reproductive Toxicity. DDT is also a recognized developmental toxicant. DDT was banned in the United States in 1973 and in Mexico in 1983.

DDT was used extensively in Imperial Valley as a low-cost, broad-spectrum insecticide (Setmire et al. 1993). The pesticide dicofol, currently in use in Imperial Valley, contains DDT and may contribute DDT metabolites to Imperial Valley. Studies in other areas of California show that DDT breakdown products have a very long lifetime in agricultural fields with clay soils (California Department of Food and Agriculture 1985), such as soils in Imperial Valley.

DDT and its metabolites are organochlorine pesticides with low water solubility. As such, they have a propensity to attach to negatively-charged clay-rich sediments, like those in Imperial Valley. Therefore, sediment-laden agricultural runoff serves as the transport mechanism by which DDT compounds adhering to soil are introduced to the drain water system. DDT metabolites have been detected in bottom sediment samples in Imperial Valley waterways (Setmire et al. 1990, Setmire et al. 1993, Eccles 1979).

DDT and its metabolites have a high propensity to store themselves in body fat, especially in the central nervous system, liver, and kidneys. In these organs, organochlorine pesticides damage important enzyme functions and disrupt biochemical cell activity (U.S. Environmental Protection Agency 1989). These properties allow DDT and its breakdown products to bioaccumulate in fish and wildlife, with severe consequences for wildlife at the top of the food chain. DDT effects on birds and aquatic organisms are well-documented by scientists throughout the world. Adverse effects include egg thinning, egg breakage, decreased egg productivity, decreased hatching and fledging success, decreased nesting success, chick mortality during hatching, and death (Kaloyanova and El Batawi 1991).

Fish and bird specimens from the Imperial Valley routinely have some of the highest DDE concentrations in California (State Water Resources Control Board 1978-1995, U.S. Environmental Protection Agency 1980, Ohlendorf and Miller 1984, Mora et al. 1987, Setmire et al. 1993). Some of the highest concentrations were found in birds feeding in agricultural fields on invertebrates and other food items (Setmire et al. 1993). Table 5 shows DDT levels in Imperial Valley fish.

Table 5: DDT in Fish Tissue -- Data from the Imperial Valley

Species	Number of Samples	Number of Organisms	Number Exceeding NAS Criteria	Number Exceeding FDA Action Level	Maximum (ppb, ww)	Mean (ppb, ww)
Bairdiella	4	24	0	0	180	84
Carp	38	128	15	4	9153	1667
Channel Catfish	34	117	20	1	5300	1861
Largemouth Bass	2	6	0	0	170	104
Flathead Catfish	2	2	0	0	241	193
Mosquitofish	9	266	5	1	5106	1413
Orangemouth Corvina	10	42	0	0	276	127
Red Shiner	1	27	1	0	1127	1127
Sailfin Molly	7	198	1	0	2577	584
Sargo	2	10	0	0	152	151
Tilapia*	7	32	0	0	326	68
Yellow Bullhead	2	3	0	0	991	550
Total	118	855	42	6		

(State Water Resources Control Board 1978-1995)

* Tilapia refers to all species of tilapia in the Colorado River Basin Region that were analyzed in the Toxic Substances Monitoring Program.

Reproductive success of colonial nesting birds has declined at the Salton Sea, likely due to high levels of multiple contaminants, particularly organochlorine pesticides, in eggs (Bennett 1998). DDE-caused reproductive depression in birds has emerged as a serious concern in the Salton Sea area. Resident birds typically have higher DDE concentrations than migratory species. The endangered California brown pelican, threatened bald eagle, and endangered peregrine falcon, among others, are exposed to DDE levels that pose a high concern level and an increased risk of adverse effects (Setmire et al. 1993). People who consume fish from Imperial Valley waterways also are at risk.

The Imperial Valley also has the highest maximum toxaphene concentration (in fish tissue) in the Colorado River Basin Region (Table 6) (State Water Resources Control Board 1978-1995). Toxaphene, like DDT, is an organochlorine chemical with low water solubility, a propensity to attach to soil particles, and a tendency to bioaccumulate in fish and wildlife. Toxaphene has a half-life in soil of up to 14 years (Genium Publishing Corporation 1999), has high chronic toxicity to aquatic life (U.S. Environmental Protection Agency 1989), and is a recognized Proposition 65 carcinogen. USEPA canceled all registered toxaphene uses in 1983 (Ware 1991). Table 7 shows toxaphene levels in Imperial Valley fish.

Table 6: Toxaphene in Fish Tissue -- Data by Surface Water for the Colorado River Basin Region

Station Location	Number of Samples	Number of Organisms	Number Exceed-ing NAS Criteria	Number Exceeding FDA Action Level	Maximum (ppb, ww)	Mean (ppb, ww)	90th Percentile (ppb, ww)
Imperial Valley	117	853	51	0	3400	323	940
Alamo River (all stations)	27	137	20	0	2200	571	1588
Alamo River/ International Boundary	4	56	3	0	300	198	288
Alamo River/ Holtville	1	3	0	0	0	0	
Alamo River/ Brawley	1	3	0	0	0	0	
Alamo River/ Calipatria	21	75	17	0	2200	697	1870
New River (all stations)	35	181	17	0	3400	333	810
New River/ International Boundary	8	85	0	0	0	0	0
New River/ Westmorland	27	96	17	0	3400	431	858
Agricultural Drains	27	393	14	0	2800	399	1128
Salton Sea	21	102	0	0	0	0	0
Fig Lake	7	40	0	0	0	0	
Wiest Lake	1	4	0	0	0	0	
Salt Creek Slough	3	6	0	0	0	0	
Coachella Valley Stormwater Channel	7	84	3	0	440	133	368
Palo Verde Outfall Drain	9	45	2	0	1200	148	344
Colorado River (all stations)	17	90	0	0	0	0	
Colorado River/ Needles	3	12	0	0	0	0	
Colorado River/ Pichaco	2	11	0	0	0	0	
Colorado River/ Upstream of Imperial Dam	3	21	0	0	0	0	
Colorado River/ Cibola	6	34	0	0	0	0	

Colorado River/ International Boundary	3	12	0	0	0	0	

(State Water Resources Control Board 1978-1995)

Table 7: Toxaphene in Fish Tissue -- Data from the Imperial Valley

Species	Number of Samples	Number of Organisms	Number Exceeding NAS Criteria	Maximum (ppb, ww)	Mean (ppb, ww)
Bairdiella	4	24	0	ND	ND
Carp	38	128	17	1800	251
Channel Catfish	34	119	26	3400	647
Largemouth Bass	1	2	0	ND	ND
Flathead Catfish	2	2	0	ND	ND
Mosquitofish	9	266	4	2800	407
Orangemouth Corvina	10	42	0	ND	ND
Red Shiner	1	27	1	260	260
Sailfin Molly	7	163	2	2000	321
Sargo	2	10	0	ND	ND
Tilapia*	50	548	0	ND	ND
Yellow Bullhead	2	3	1	120	60

(State Water Resources Control Board 1978-1995)

* Tilapia refers to all species of tilapia in the Colorado River Basin Region that were analyzed in the Toxic Substances Monitoring Program.

ND = Not detected

NUMERIC TARGET

This section describes the numeric target that will be used to reduce sediment loads to meet water quality objectives (Table 1) that protect Imperial Valley Drain beneficial uses (Table 2).

A. NUMERIC TARGET

The numeric target established by this TMDL is an annual average in-stream total suspended solids (TSS) concentration of 200 mg/L. Achieving the target is expected to result in the subject drains being: (a) unimpaired by sedimentation/ siltation and, (b) protective of beneficial uses.

B. BASIS FOR NUMERIC TARGET

TSS and turbidity were chosen as water column sediment indicators, in accordance with USEPA's *Protocol for Developing Sediment TMDLs* (U.S. Environmental Protection Agency 1999), due to average sediment concentrations and availability of TSS and turbidity data. The numeric target was based on available data, including 1997-2002 Imperial Irrigation District data, Toxic Substances Monitoring Program data (State Water Resources Control Board 1978-1995), and 2002 Regional Board data. (Data is contained in Appendix B.) This data was assessed in relation to recommendations of the National Academy of Sciences (NAS)[1], which stated a range of values for suspended solids that generally would be protective of aquatic ecosystems. This range of values included both warmwater and coldwater streams. In 1986 and 2002, USEPA reaffirmed the NAS recommendations (U.S. Environmental Protection Agency 1986, U.S. Environmental Protection Agency 2002).

NAS recommends the following general maximum total suspended solids (TSS) concentrations to protect aquatic life (U.S. Environmental Protection Agency 1973):

High Level of Protection	25 mg/L
Moderate Protection	80 mg/L
Low Level of Protection	400 mg/L

NAS recommendations were based on a literature survey of direct effects of suspended solids on freshwater fish life cycles, performed by the European Inland Fisheries Advisory Council (EIFAC), an international Advisor Institution that conducts studies on different worldwide topics (European Inland Fisheries Advisory Council 1965). The EIFAC literature survey revealed that healthy fisheries sometimes occur at concentrations of 80 to 400 mg/L TSS. However, death rate is substantially greater for fish living for long periods in waters containing TSS in excess of 200 mg/L than for fish living in cleaner water. Only poor fisheries are likely to be found in waters that normally carry greater than 400 mg/L TSS.

Accordingly, the proposed numeric target considers local watershed characteristics, including the warmwater nature of the Imperial Valley drain system. Warmwater streams are often muddy with silt and sandy bottoms, and are generally more turbid than coldwater streams (Waters 1995). The proposed numeric target (200 mg/L) is within the upper range of NAS and EIFAC recommendations. The numeric target is not based on a standard for coldwater trout streams or what the actual background water quality could be (which would have resulted in a more stringent target). Additionally, the numeric target also

[1] NAS guidelines assess pollutant bioaccumulation. NAS guidelines were established to protect organisms exposed to toxic compounds and to protect species that consume these contaminated organisms.

was based on other scientific literature (Wood and Armitage 1997, LeBlanc et al. 2003), Management Practice efficiency and cost, and staff professional judgment.

C. EXISTING CONDITIONS COMPARED TO NUMERIC TARGET

Existing TSS varies among the subject drains. However, all subject drains have current TSS measurements in excess of the numeric target. Table 8 compares existing TSS measurements to the numeric target. Raw TSS data is contained in Appendix B.

Table 8: Comparison of Existing Conditions to Numeric Target – Annual Average at the Outlet

Drain Name	Existing TSS (mg/L)	Target TSS (mg/L)
Niland 2	410	200
P	235	200
Pumice	610	200
All Drains	**418**	**200**

SOURCE ANALYSIS

This section identifies and quantifies natural and human-related sediment sources to the subject drains (Niland 2, P, and Pumice), including their tributary drains. A source analysis is important in determining the: (a) amount of sediment reduction needed to meet numeric targets, and (b) allocations to be distributed among sediment sources.

A. METHODOLOGY

The source analysis methodology is the same one used for previous sediment/ silt TMDLs (e.g., Alamo River, New River) in the Region. Total suspended solids (TSS) and turbidity data are from Regional Board water samples collected in 2002, and analyzed by a contract laboratory, pursuant to a Quality Assurance Project Plan. (Water samples were collected at drain outlets.) Daily irrigation delivery and monthly drain flow data from January 1997 to December 2002 are from Imperial Irrigation District (Imperial Irrigation District 2003). Raw data and calculations are contained in Appendix B.

Prior to analysis, data were statistically evaluated to determine whether they were normally distributed. Data also were analyzed for potential outliers using Chauvinet's Criterion, as recommended by Kennedy and Neville 1986. Outlier data were not included in the analysis.

A mass balance approach was used to analyze TSS concentration and the corresponding sediment load for each subject drain, to determine total sediment load for all subject drains combined. Total sediment load in the subject drains is the sum of sediment contributions from individual sources. Sediment sources include agricultural tailwater, dredging, natural sources (i.e., in-stream erosion and wind deposition), storm event runoff from farm land, and urban runoff. Therefore, total sediment load to the subject drains can be represented mathematically by the following formula:

$$L_{\text{Drains}} = L_{\text{Tailwater}} + L_{\text{Dredging}} + L_{\text{Natural Sources}} + L_{\text{Storm Event Runoff from Farm Land}} + L_{\text{Urban Runoff}}$$

where:

L_{Drains}	=	total sediment load to the subject drains
$L_{\text{Tailwater}}$	=	sediment load from agricultural tailwater
L_{Dredging}	=	sediment load from dredging
$L_{\text{Natural Sources}}$	=	sediment load from natural sources, specifically in-stream erosion and wind deposition
$L_{\text{Storm Event Runoff from Farm Land}}$	=	sediment load from storm event runoff from farm land
$L_{\text{Urban Runoff}}$	=	sediment load from urban runoff

Load from Agricultural Tailwater

Agricultural sediment load was calculated by multiplying TSS concentration (average at the outlet, in mg/L) by flow (annual average over six years, in acre-feet), then using a factor to convert TSS concentration (mg/L) into sediment load (average, in tons/year). Tributary drain data were incorporated into the appropriate subject drain. Agricultural tailwater flow was derived as being proportional to irrigation delivery flow.

Load from Dredging

Dredging load was calculated by multiplying the percent of flow affected by dredging (total flow x percent of time that dredging occurs in any drain) by the TSS concentration and by a factor to convert mg/L to tons. Data used in calculations are in Appendix B, and include: (a) Imperial Irrigation District (IID) flow data, (b) IID annual sediment removal information (Knell 2000), from which a ratio was used to determine the amount of time that maintenance crews spend dredging the subject drains per year (determined to be 0.8%, as shown in Appendix B), and (c) Regional Board monitoring of an IID dredging operation, which showed that dredging increased downstream TSS concentration from the low hundreds to as high as 5,000 mg/L.

Load from Natural Sources (In-Stream Erosion and Wind Deposition)
Natural source (in-stream erosion and wind deposition) load was calculated by multiplying the total flow for all subject drains in acre-feet by the estimated natural sources TSS annual average in mg/L by a conversion factor to convert mg/L to tons.

Load from Potential (Calculated) Storm Event Runoff from Farm Land
The load for storm event runoff from farm land was calculated using: (a) total acreage of farmland that could influence the subject drains, (b) recorded precipitation data from 1997 through 2002 (California Department of Water Resources 1997-2002), and (c) a TSS value of 418.3 mg/L (annual average for all drains combined—see Appendix B).

B. SEDIMENT SOURCES AND CONTRIBUTIONS

This source analysis shows that agricultural tailwater is the primary sediment source to the subject drains. Dredging is another major sediment source. Natural sources (in-stream erosion and wind deposition) and storm event runoff from farm land are relatively insignificant sediment sources.

Urban runoff and National Pollutant Discharge Elimination System (NPDES) facilities are not sediment sources. NPDES facilities do not discharge into the subject drains. Urban communities are too far from the subject drains to impact them. Niland, Calipatria, and Westmorland are the closest communities (2 or more miles) to the subject drains (MapQuest 2003). Urban runoff from these communities drains into the New River or other agricultural drains.

An analysis of each sediment source is described below.

Agricultural Tailwater
Agricultural tailwater is a major sediment source, and the primary sediment source, to the subject drains. This is because nearly 100% of the subject drains' water originates from agricultural return flows, within which tailwater is the major source (48%) of flow volume (Jensen and Walter 1997). Agricultural return flows also are composed of tilewater, seepage, and operational spills, but these water sources are relatively sediment-free, and serve to dilute sediment concentrations. Tailwater is applied irrigation water that does not percolate into soil, thereby exiting at the lower end of the field, into an IID drain. Tailwater tends to erode a field as water flows across the surface, acquiring silt and sediment on the way into a drain.

Average TSS concentration in the subject drains is approximately 418 mg/L. This corresponds to a tailwater contribution of 25,790 tons/year to the subject drains. Table 9 shows the present average annual flow, average TSS, and average annual sediment load for the subject drains.

Table 9: Existing Flow, TSS, and Load for All Drains

Drain Name	Flow Annual Average (acre-feet/year)	TSS Annual Average (mg/L)	Sediment Load Annual Average (tons/year)
Niland 2	1,264	410	705
P	2,688	235	859
Pumice	41,388	610	34,328
All Drains	**45,340**	**418**	**25,790**

Dredging

Dredging is a major sediment source to the subject drains. Many drains require periodic dredging to maintain adequate drainage, due to sediment loads received from agricultural fields. Dredging is not an independent source of sediment. Rather, dredging suspends sediment generated by other sources--mostly from agricultural tailwater, with small contributions from natural sources and storm event runoff from farm land. Dredging potentially suspends about 2,466 tons/year of sediment from the subject drains:

45,340 acre-feet/year x 0.008 x 5,000 mg/L x 0.0013597 = 2,466 tons/year

where: 45,340 acre-feet/year = total flow for the subject drains (i.e., annual average)
0.008 = amount (i.e., 0.8% in decimal form) of time that maintenance crews spend dredging the subject drains per year (see Appendix B)
5,000 mg/L = TSS concentration downstream of a dredging event
0.0013597 = conversion factor from mg/L to tons/year
2,466 tons/year = amount of sediment suspended by dredging in the subject drains

Some of this sediment becomes suspended into the water, though the amount is unknown.

Natural Sources (In-Stream Erosion and Wind Deposition)

Natural sources are a relatively insignificant sediment source to the subject drains. Local soils are mostly colloidal clays and silts (Table 10). These soils tend to be cohesive, and therefore not easily eroded by water or wind. Width and depth of channels remain relatively constant from year to year.

Table 10: Imperial Valley Soil Associations

Soil Association	Description	Composition	Slope	Permeability
Imperial	Moderately well-drained silty clay. Very deep, calcareous soils. Natural drainage has been altered by irrigation canal seepage and extensive irrigation.	85% Imperial soils 15% minor soils	less than 2%	Low
Imperial-Holtville-Glenbar	Moderately well-drained silty clay, silty clay loam, and clay loam. Very deep calcareous soils. Natural drainage has been altered by irrigation canal seepage and extensive irrigation.	40% Imperial soils 20% Holtville soils 20% Glenbar soils 20% minor soils	less than 2%	Low
Meloland-Vint-Indio	Well-drained fine sand, loamy very fine sand, fine sandy loam, very fine sandy loam, loam and silt loam. Very deep, calcareous soils. Natural drainage has been altered by irrigation canal seepage and extensive irrigation.	30% Meloland soils 25% Vint soils 20% Indio soils 25% minor soils	less than 2%	Low

(Zimmerman 1981)

In-stream (i.e., in-drain) erosion also is limited because: (a) water flow is relatively slow due to terrain flatness and the presence of weirs and/or drop structures, and (b) portions of drain channel banks are vegetated. Wind deposition also is limited because: (a) the channel bank area exposed to wind is relatively small, and (b) most wind-blown "sand" is likely to settle on land, as the watershed has substantially more land surface area than water surface area. Natural sources contribute an estimated 10 mg/L of TSS, which corresponds to 616.5 tons/year of sediment.

Potential (Calculated) Storm Event Runoff from Farm Land

Storm event runoff from farm land is a relatively insignificant sediment source to the subject drains. The following analysis supports this conclusion.

A total of 10,463 acres of active (non-idle) farmland drain into the subject drains. However, the Imperial Valley has an arid climate, with about 2 inches of rain per year from 1997-2002 (California Department of Water Resources 1997-2002). Therefore, storm event runoff from farm land can be disregarded except for areas that were being irrigated just before, during, and just after the storm[2]. About 5% of Imperial Valley farmland is irrigated on any given day (Bali 2000). Therefore, about 523 acres are irrigated on any given day in the study area (5% of 10,463 acres). This acreage potentially could generate storm event runoff, particularly if soils already were saturated from irrigation.

[2] Valley farmers order water deliveries two days ahead of time, and may not be able to factor in precipitation (to reduce their water orders) if the storm was not forecast before the order.

Table 11 summarizes the analysis. These figures were calculated, not measured, and represent a worst-case scenario. Even in a worst-case scenario, the amount of storm event runoff from farm land is minimal. Detailed calculation methods and data are in Appendix B.

Table 11: Summary of Potential Storm Event Runoff from Farm Land

Year	Flow (acre-feet/year) from Storm Event Runoff from Farm Land	% of Total Drain Flow	Load (tons/year) from Farmland Runoff	% of Total Drain Load
1997	159.1	0.3%	90.5	0.3%
1998	142.1	0.3%	80.8	0.3%
1999	87.6	0.2%	49.8	0.2%
2000	57.1	0.1%	32.5	0.1%
2001	72.8	0.2%	41.4	0.2%
2002	13.9	0.03%	7.9	0.03%
Annual Average	**88.8**	**0.2%**	**50.5**	**0.2%**

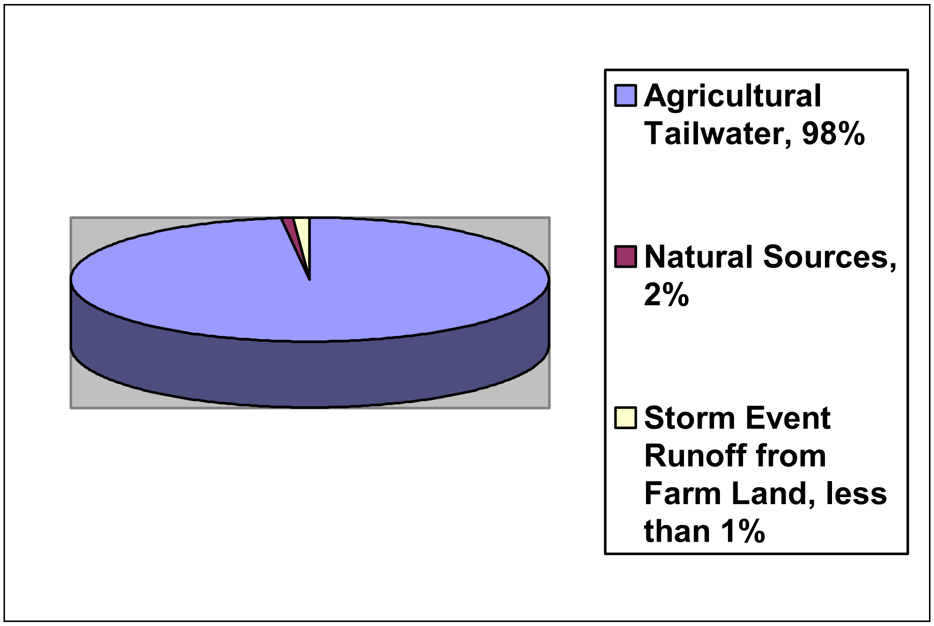
Summary of Sediment Sources

The source analysis is summarized numerically in Table 12, and graphically in Figure 2. Agricultural tailwater is the major source of sediment to the subject drains. (Dredging is not included as a sediment source, as dredging is not an independent source of sediment. See explanation on page 17 under "Dredging".)

Table 12: Sediment Source Summary

Sediment Source	Flow (acre-feet/year)	Percent of Total Drain Flow	Sediment Load (tons/year)	Percent of Total Drain Load
Agricultural Tailwater	45,340.2	99.8%	25,789.6	97.5%
Natural Sources	0	0%	616.5	2.3%
Storm Event Runoff from Farm Land	88.8	0.2%	50.5	0.2%
All Sources	**45,429**	**100%**	**26,456.6**	**100%**

Figure 2: Sediment Source Summary - Percent of Total Drain Load



SEASONAL VARIATIONS AND CRITICAL CONDITIONS

This section describes seasonal variations and/or critical conditions that have the strongest impact on load conditions. Understanding such conditions is important in achieving TMDL goals.

A. DEFINITION

This TMDL determines the subject drains' assimilative capacity, and allocates loads to achieve water quality criteria. The critical condition is the set of environmental factors identified to ensure attainment of objectives under varying conditions. The critical condition typically is the time period (season) that the waterbody is most vulnerable, often due to changes in land usage or weather.

B. LOCAL CLIMATE

Imperial Valley drains are located in Imperial Valley, within Imperial County, California. The drains are in the Colorado Desert region of the Sonoran Desert. The climate is hot, with warm winters, dry summers, occasional thunderstorms, and gusty high winds with sandstorms. The area is one of the most arid in the United States, with an average annual rainfall of about two inches and temperatures in excess of 100ºF for more than 100 days per year. Average temperature is 54ºF in January, and 92ºF in July. Imperial Valley evapotranspiration rates can exceed 84 inches per year, and can be one-third inch per day in hot summer months. Therefore, climate is relatively stable throughout the year, without the wide swings in temperature and rainfall found in other parts of the country.

C. LOCAL WATER FLOW

Imperial Valley drains are owned and operated by Imperial Irrigation District (IID), which uses a 1,668-mile system of main and lateral canals to deliver water to 500,000 acres of Imperial Valley farmland (Imperial Irrigation District 1998). Nearly all (98%) of IID-transported water is used for agriculture, with a relatively small amount (2%) used for drinking water for nine Imperial Valley cities (Imperial Irrigation District 1998).

Irrigation activities are less frequent during the winter months when temperatures and evapotranspiration are lowest. Therefore, less water is diverted into the canals, and flows are lowest, during the winter months.

D. IDENTIFIED SEASONAL VARIATIONS AND CRITICAL CONDITIONS

Strong seasonal differences exist regarding local water flow, but not local climate (Appendix B). Sediment becomes suspended in tailwater regardless of the season. However, more flow at certain times of year means that more sediment becomes suspended in drains at certain times of year. To address this seasonal variation, the numeric target is expressed in terms of an annual average. If data for certain months exceeds the load allocation, this may be tempered by low data readings in other months. Therefore, variability is accounted for and addressed by use of an annual average.

LINKAGE ANALYSIS

This section describes the relationship (i.e., linkages) between the numeric target, sediment sources, allocations, and assimilative capacity.

The major sediment source to the subject drains is agricultural tailwater. The subject drains' assimilative capacity for sediment is defined as the highest sediment load that the drains can assimilate without exceeding the numeric target. Therefore, assimilative capacity is based on the numeric target, which is expressed as a concentration (mg/L). To determine assimilative capacity, the numeric target concentration must be converted to a sediment load (tons/year) based on the amount of water flow, while also accounting for natural sources and a margin of safety. The allowable sediment load includes load allocations, wasteload allocations, and future growth. Assimilative capacity for any time period can be expressed mathematically as:

Assimilative Capacity = Allowable Sediment Load + Natural Sources Load + Margin of Safety Load

Therefore, assimilative capacity of the subject drains at the 200 mg/L numeric target (detailed calculations are in Appendix C) is:

Assimilative Capacity = 11,097 + 616.5 + 616.5 = 12,330 tons/year

These allocations, when achieved, are expected to result in suspended sediment concentrations that are within the assimilative capacity of the subject drains, thus achieving the numeric target.

LOAD ALLOCATIONS AND WASTELOAD ALLOCATIONS

This section quantifies and allocates the amount of sediment reduction required to attain Water Quality Standards. Allocations are:

(a) best estimates based on data availability and appropriate prediction techniques, as stated in 40 Code of Federal Regulations (CFR) 130.2(g).
(b) required for all nonpoint sources, such as agricultural drains, as stated in 40 CFR 130.2(g).

A. METHODOLOGY

The allowable load was distributed among sediment sources, and included a margin of safety to account for uncertainty, as recommended by USEPA's TMDL Guidelines (U.S. Environmental Protection Agency 1991). Therefore, a TMDL is the sum of load allocations for nonpoint sources (e.g., agricultural drains), individual wasteload allocations for point sources (e.g., wastewater treatment plants), natural sources (e.g., in-stream erosion and wind deposition), and a margin of safety. This can be represented by the following formula:

TMDL = Load Allocations + Wasteload Allocations + Natural Sources + Margin of Safety

Allocations were based on the Source Analysis and Numeric Target of this TMDL. Calculations were conducted by subtracting the natural sources allocation and margin of safety from the numeric target (in terms of concentration in mg/L). The allocation for human-made sources (e.g., the drains) was then distributed among the remaining allowable load. Methodology for each allocation is described below in more detail.

Load Allocations for Nonpoint Sources
The load for each drain was based on the drain's proportion of flow to the total flow. This equitably allocated the load among drains because drains with a higher flow tend to serve more acreage and thus carry a higher sediment load. Similarly, drains with a lower flow tend to serve less acreage and thus carry a lower sediment load. All calculations were then converted from concentration (in mg/L) to load allocations (in tons/year).

Wasteload Allocations for Point Sources
Point sources (e.g., wastewater treatment plants) do not discharge into the subject drains. However, an allocation for point sources is included to account for potential future growth (i.e., more municipal wastewater services for an increased population). A larger population would mean more wastewater discharge, which would be handled through wastewater treatment plants (WWTPs). WWTPs are permitted, and thus required to meet a sediment standard in their discharge. Therefore, any discharge from future WWTPs into the subject drains would dilute sediment concentrations because WWTP discharge has relatively little sediment in comparison to agricultural tailwater.

A wasteload allocation was established to serve as an unallocated reserve for future growth, and was set at 3% of the total load of the drains. This percentage reflects local population projections, and was based on figures from the New River Sedimentation/ Siltation TMDL, where future growth accounted for 3% of the total load.

Natural Sources
The natural sources concentration was estimated to be 10 mg/L, based on local conditions that limit in-stream erosion and wind deposition. These local conditions include soil type, terrain flatness, presence of weirs and/or drop structures, and partially vegetated drain channel banks. (These conditions are discussed in more detail on page 18 under the heading "Natural Sources.")

Margin of Safety
The margin of safety concentration was estimated to be 10 mg/L, equal to the natural source concentration. Therefore, if the actual natural sources load is up to double the estimated load, then the margin of safety will ensure that the numeric target is met.

B. SPECIFIC ALLOCATIONS BY SOURCE

Table 13 summarizes load allocations, which are distributed among the Niland 2 drain, P drain, Pumice drain, future growth, natural sources, and margin of safety. Detailed calculations are in Appendix C.

Table 13: Load Allocations Summary

Sediment Source	# of Drains Included in Segment	Sediment Load Allocation (tons/year)
Niland 2 drain	1	300.3
P drain	1	638.3
Pumice drain (including 5 Vail drains that drain into it)	6	9,825.3
Future Growth	None	332.9
Total Load Allocation for drains @ TSS = 180 mg/L	**8**	**11,097**
Natural Sources	Not applicable	616.5
Margin of Safety	Not applicable	616.5
Total Load Allocation for other sources @ TSS = 20 mg/L	**Not applicable**	**1,233**
TOTAL ASSIMILATIVE CAPACITY (Total Allocation for all sources @ TSS = 200 mg/L)	**8**	**12,330**

C. WATER TRANSFER PROPOSALS

A recently signed water transfer plan by Imperial Irrigation District (IID) will affect irrigation water deliveries to IID service areas. This Colorado River Quantification Settlement Agreement involves a decrease in IID irrigation deliveries of as much as 300,000 acre-feet/year, which will result in a decrease in the amount of water that drains from farmland into the Imperial Valley Drains. The transferred water will be irrigation water "conserved" by IID and Imperial Valley farmers. This water will be diverted to other water agencies (e.g., San Diego County Water Authority).

Decreased irrigation deliveries result in the same concentration, but a lower load, due to decreased water flow. The corresponding flow in the subject drains would be 31,630 acre-feet/year, assuming that the 300,000 acre-feet/year irrigation delivery reduction will result in an equal decrease in total drain flow as a worst-case scenario. The calculation follows below:

subject drain total flow - (water transfer loss x (subject drain total flow / IID total flow))

45,340 – (300,000 x (45,340 / 992,122)) = 31,630 acre-feet/year

The corresponding load in the subject drains would be 17,990 tons/year, as opposed to the 25,790 tons/year now with the current flow. The calculation follows below:

flow x TSS x conversion factor

31,630 x 418.3 x .0013597 = 17,990 tons/year

IMPLEMENTATION PLAN

TMDL compliance by responsible parties will be based on meeting the load allocation (annual average), derived from the numeric target. Compliance will not be based on the numeric target itself. (A TMDL's numeric target is an interpretation of existing water quality standards, but is not a water quality standard itself.)

A. RESPONSIBLE PARTIES (DISCHARGERS)

All waste dischargers are responsible for their waste quality and for ensuring that discharges do not adversely impact beneficial uses of waters of the State. For this TMDL, dischargers include the Imperial Irrigation District, farm landowners, renters/lessees, and operators/growers discharging or potentially discharging wastes into waters of the State.

Imperial Irrigation District
Imperial Irrigation District (IID) is the largest stakeholder within the project area. IID operates and maintains irrigation canals and agricultural drains, including the subject drains.

Farm Landowners, Renters/Lessees, and Operators/Growers
Landowners have discretionary control of their land, and therefore have ultimate responsibility to control practices on their lands. Landowners ultimately are responsible for cleanup regarding renter/lessee practices. Renters/lessees also have responsibility for pollution control, as they have day-to-day control of farming operations.

Operators/growers are dischargers, as they have day-to-day control over farming operations and waste discharges. Operators/growers are defined as IID agricultural water account holders who purchase water from IID to irrigate farmland and, as a result, are likely to discharge waste into waters of the State.

B. THIRD PARTY COOPERATING AGENCIES AND ORGANIZATIONS

Cooperating agencies and organizations have technical expertise and resources that facilitate effective implementation of practices to address sediment pollution.

University of California Cooperative Extension, Holtville Field Station
University of California Cooperative Extension (UCCE) offers workshops, programs, training courses, and technical assistance to growers on a broad range of agricultural topics. The UCCE Holtville Field Station conducts demonstration projects and research for erosion control.

U.S. Department of Agriculture Natural Resources Conservation Service
United States Natural Resources Conservation Service (NRCS) provides technical aid in securing financial assistance to support implementation of Management Practices (MPs). The *Field Office Technical Guide* (Natural Resources Conservation Service 1996) contains technical standards and specifications of MPs.

Imperial County Farm Bureau
Imperial County Farm Bureau (ICFB) initiated a Watershed Program to conduct outreach programs and to foster effective self-determined attainment of TMDL loads. Specific goals of the Watershed Program include:

- coordination of workshops with local technical assistance agencies

- provision of demonstration sites for MP field-testing
- cooperation with Regional Board staff to track and report MP effectiveness

C. MANAGEMENT PRACTICES

Management Practices (MPs) are methods applied before, during, and after discharge-producing activities to reduce or eliminate the introduction of pollutants into receiving waters. This staff report uses the term “Management Practice (MP)” instead of the term "Best Management Practice (BMP)". The “Best Management Practice” term was used in previous sedimentation/ siltation TMDLs and may be used in some support documents for this TMDL if written prior to the term change or written by persons outside of the TMDL Development Unit. The term “Best Management Practice (BMP)” may imply that the practice is the most effective option in all circumstances. Rather, experience and site-specific information should be considered when selecting a MP.

Sediment-control MPs work by limiting irrigation water velocity and making the field more resistant to erosive forces. Effectiveness of sediment MPs is dependent on site-specific and crop-specific conditions. Therefore, landowners and operators are the best parties to identify which MPs are most appropriate for TMDL attainment. Additionally, effectiveness can be increased greatly when different MPs are used together (Kalin 2003). Technical resource agencies and organizations may be of assistance.

Each MP discussed below was evaluated for cost effectiveness, sediment/silt reduction effectiveness, anticipated acceptability by farmers, and likeliness of widespread implementation. This information is contained in the CEQA Environmental Checklist and Determination, a supporting document to this staff report.

Public Involvement in MP Identification and Development

During TMDL development, the Technical Advisory Committee (TAC) formed an On-Field Sediment MP Subcommittee who prepared a list of recommended MPs (Appendix D). Additionally, UCCE submitted a list of recommended MPs (Appendix E). Regional Board staff evaluated both lists and discussed MPs with TMDL TAC members at three TAC meetings, during which language revisions were made. Those changes are incorporated herein.

On-Field Sediment-Control MPs

The following are on-field, sediment-control MPs (references are in brackets):

- **Maintenance of Field Drainage Structure (Imperial Irrigation District Regulation No. 39)**
  Imperial Irrigation District’s Regulation 39 states, in part, “It is the responsibility of each water user to maintain a tailwater structure and approach channel in acceptable condition, in order to qualify for delivery of water. An acceptable structure shall have vertical walls and a permanent, level grade board set a maximum of 12 inches below the natural surface. If the situation warrants, and at the discretion of the district, 18 inches maximum may be allowed”.

  {Imperial Irrigation District Regulation No. 39, Silt TMDL TAC, Consistent with Natural Resource Conservation Service (NRCS) Field Office Technical Guide (FOTG) Conservation Practice “Structure for Water Control” (Code 587), Consistent with Jones & Stokes BMP #1: Improved Drop Box}

- **Tailwater Drop Box with Raised Grade Board**
  This practice involves maintenance of the grade board at an elevation high enough to minimize erosion. In many situations, the grade board elevation can be set higher than required by IID

regulations, especially when anticipated tailwater flows will not reach an elevation that will cause crop damage. Jones & Stokes (Jones & Stokes Associates 1996) rated this MP as having a demonstrated positive sediment transport reduction effect and a relatively low cost.

{Silt TMDL TAC, Consistent with NRCS FOTG Conservation Practice “Structure for Water Control” (Code 587), Consistent with Jones & Stokes BMP #1: Improved Drop Box}

- **Improved Drop Box with Widened Weir and Raised Grade Board**
  This practice involves widening the drop box overpour weir and maintaining the grade board at an elevation high enough to minimize erosion. Widening the drop box overpour weir enables the weir elevation to be set higher without raising the surface elevation of water above the acceptable level. Higher weir elevations allow an increased tailwater ditch cross-section, and reduced erosion when water leaving the field enters the tailwater ditch. Jones & Stokes (Jones & Stokes Associates 1996) rated this MP as having a demonstrated positive sediment transport reduction effect (sediment reduction efficiency of 40% to 60%) and a relatively low cost.

  {Silt TMDL TAC, Consistent with NRCS FOTG Conservation Practice “Structure for Water Control” (Code 587), Jones & Stokes BMP #1: Improved Drop Box}

- **“Pan Ditch” -- Enlarged Tailwater Ditch Cross-section**
  This practice involves deepening and widening the tailwater ditch, which results in decreased tailwater velocity and depth. Water must be checked downstream of the oversized area to make the water cross-section as large as practical. The slower the velocity, the more sediment will settle out of the water and stay in the field, and the less will be picked up by moving water. The effectiveness of this MP is further improved by planting grass filter strips in the tailwater ditch and/or installing tailwater ditch checks.

  {Silt TMDL TAC}

- **Tailwater Ditch Checks or Check Dams**
  Tailwater Ditch Checks are temporary or permanent dams that hold water level well above ground. They can be placed at intervals in tailwater ditches, especially those with steeper slopes. They increase the cross-section of the stream of water, decrease water velocity and reduce erosion, and may cause sediment already in the water to settle out. Tailwater Ditch Checks can be constructed of plastic, concrete, fiber, metal, or other suitable material. If plastic sheets are used, care must be taken not to allow plastic pieces to be carried downstream with water. In order to be effective, this MP must be utilized where water velocities will not wash out check dams or sides of the tailwater ditch around the dams. Tailwater ditch checks or check dams are expected to work best in wide “pan ditches” where tailwater stream width can be increased effectively. Jones & Stokes (Jones & Stokes Associates 1996) rated this MP as having a likely positive effect on sediment transport reduction and a relatively low cost.

  {Silt TMDL TAC, Jones & Stokes BMP #2: Portable Check Dams}

- **Field to Tailditch Transition**
  This practice involves controlling water flow from the field into the tailwater ditch through spillways or pipes without washing across and eroding soil. Spillways might be constructed of plastic, concrete, metal, or other suitable material. If plastic sheets are used, care must be taken not to allow plastic pieces to be carried downstream with water. This procedure may be useful on fields irrigated in border strips and furrows. Care must be taken to address erosion that may be caused where the spillway discharges to the tailditch.

{Silt TMDL TAC}

- **Furrow Dikes (also known as "C-Taps")**
  Furrow dikes are small dikes created in furrows to manage water velocity in the furrow. They can be constructed of earth and built with an attachment to tillage equipment, pre-manufactured "C-Taps," or other material, including rolled fiber mat, plastic, etc. Jones & Stokes (Jones & Stokes Associates 1996) rated this MP as having a likely positive sediment transport reduction effect and a relatively low cost.

  {Silt TMDL TAC}

- **Filter Strips**
  This practice involves border elimination on the field's last 20 to 200 feet. The planted crop is maintained to the field's end, and tailwater from upper lands is used to irrigate the crop at the ends of adjacent lower lands. The main slope on the field's lower end should be no greater than on the balance of the field. A reduced slope might be better. With no tailwater ditch, very little erosion occurs as water slowly moves across a wide area of the field to the tailwater box. Some sediment might settle out as the crop slows the water as it moves across the field. This could be used with water-tolerant crops or special soil conditions. Jones & Stokes (Jones & Stokes Associates 1996) rated this MP as having a demonstrated positive sediment transport reduction effect (sediment reduction efficiency of 40% to 65%) and a relatively low to medium cost.

  {Silt TMDL TAC, Consistent with NRCS FOTG Conservation Practice "Filter Strip" (Code 393), Jones & Stokes BMPs #4: Filter Strips}

- **Irrigation Water Management**
  Irrigation water management is defined as determining and controlling irrigation water rate, amount, and timing in a planned manner. Effective implementation can result in minimizing on-farm soil erosion and subsequent sediment transport into receiving waters. Specific irrigation water management methods include: surge irrigation, tailwater cutback, irrigation scheduling, and runoff reduction. In some cases, irrigation water management could include employment of an additional irrigator to better monitor and manage irrigation water and potential erosion.

  {Consistent with NRCS FOTG Conservation Practice "Improved Water Application" (Code 197, CA Interim), Consistent with NRCS FOTG Conservation Practice "Irrigation Water Management" (Code 449), Jones & Stokes BMPs #8: Improved Irrigation Scheduling, #9: Gated Pipe Irrigation, #11:Cut-Back Irrigation, #12: Cablegation, #15: Surge Irrigation}

- **Irrigation Land Leveling**
  This practice involves maintaining or adjusting field slope to avoid excessive slopes or low spots at a field's tail end. It might be advantageous in some cases to maintain a reduced main or cross slope, which facilitates more uniform distribution of irrigation water and can result in reduced salt build-up in soil, increased production, reduced tailwater, and decreased erosion. Jones & Stokes (Jones & Stokes Associates 1996) rated this MP as having a sediment reduction efficiency of 10% to 50%, and a medium to high cost.

  {Silt TMDL TAC, Consistent with NRCS FOTG Conservation Practice "Irrigation Land Leveling" (Code 464), Jones & Stokes BMPs #13 and #14: Land Leveling, Slope Adjustments, Tail End Flattening, and Dead Leveling}

- **Sprinkler Irrigation**
  Sprinkler irrigation involves water distribution by means of sprinklers or spray nozzles. The purpose is to apply irrigation water efficiently and uniformly to maintain adequate soil moisture for optimum plant growth without causing excessive water loss, erosion, or reduced water quality. Jones & Stokes (Jones & Stokes Associates 1996) rated this MP as having a demonstrated positive sediment transport reduction effect (sediment reduction efficiency of 25% to 35% if utilized during germination, and 90% to 95% for an established crop), and a relatively high cost.

  {Consistent with NRCS FOTG Conservation Practice "Irrigation System, Sprinkler" (Code 442), Jones & Stokes BMPs #17 and #18: Irrigation Sprinkler Systems}

- **Drip Irrigation**
  Drip irrigation consists of a network of pipes and emitters that apply water to soil surface or subsurface in the form of spray or small stream.

- **Reduced Tillage**
  This practice involves elimination of at least one cultivation per crop. It integrates weed control practices to maximize effectiveness, but minimizes erosion and sedimentation that may occur in the furrow.

Off-Field Sediment Control MPs
The following are off-field sediment-control MPs (references are in brackets):

- **Channel Vegetation / Grassed Waterway**
  This practice involves establishing and maintaining adequate plant cover on channel banks to stabilize channel banks and adjacent areas, and to establish maximum side slopes. This practice reduces erosion and sedimentation, thus reducing bank failure potential.

  {Consistent with NRCS FOTG Conservation Practice "Channel Vegetation" (Code 322), and NRCS FOTG Conservation Practice "Grassed Waterway" (Code 412)}

- **Irrigation Canal or Lateral**
  This practice applies to irrigation drainage channels. One objective is to prevent erosion or water quality degradation. Drainage channels should be designed to develop velocities that are non-erosive for the soil materials from which the channel is constructed.

  {Consistent with NRCS FOTG Conservation Practice "Irrigation Canal or Lateral" (Code 320)}

- **Sedimentation Basins**
  Sedimentation basins collect and store debris or sediment. Sedimentation basin capacity should be sufficient to store irrigation tailwater flows long enough to allow most sediments within the water to settle out. Sedimentation basins also must be cleaned regularly to maintain capacity and effectiveness.

Effectiveness Monitoring
Effectiveness monitoring (also known as management monitoring) is used to evaluate effectiveness of MPs. Effectiveness monitoring should be implemented in conjunction with technical assistance (e.g., UCCE) to ensure that data will be useful.

There is a lack of quantitative data regarding MP performance under local conditions. However, MPs currently are being implemented (Imperial Valley Farm Bureau 2003) in compliance with the Alamo River and New River Sedimentation/ Siltation TMDLs, and their performance is being assessed (The Redlands Institute 2003). Performance data will be considered in future TMDL revisions. Regional Board staff will work cooperatively with ICFB and IID to determine appropriate monitoring and tracking/reporting protocols to assess MP performance.

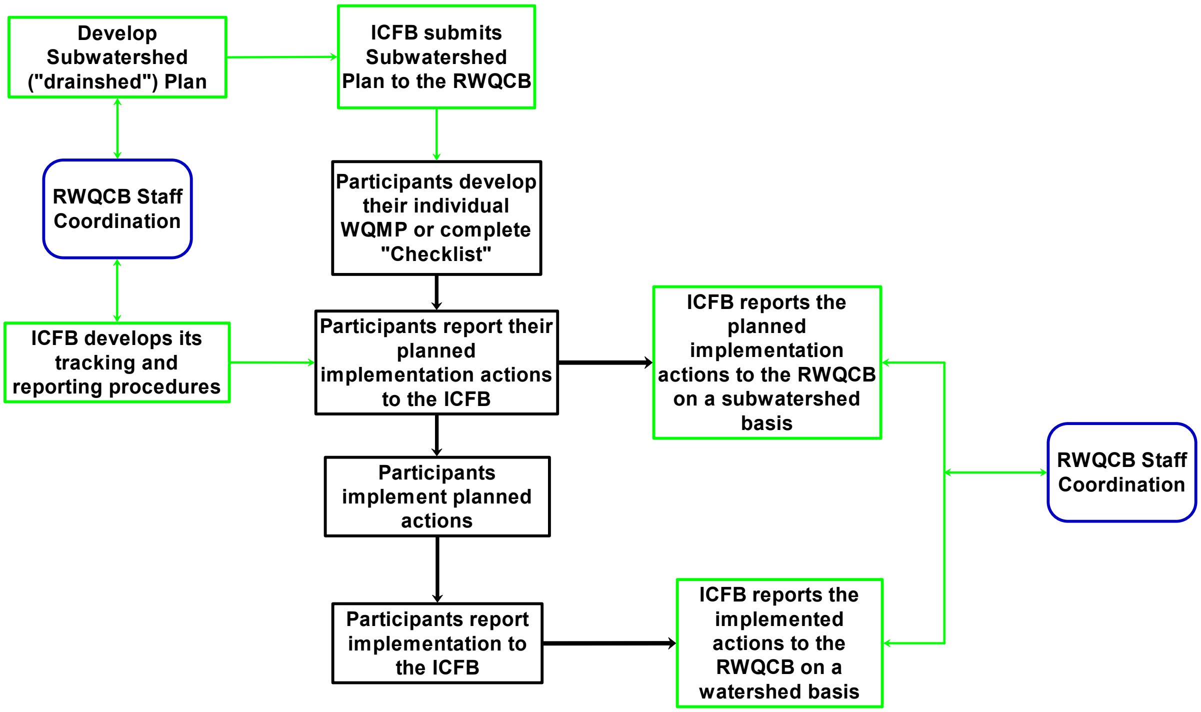
D. NONPOINT SOURCE MANAGEMENT PLAN TO ACHIEVE TMDL COMPLIANCE

TMDL implementation involves compliance with the State's Nonpoint Source Management Plan (State Water Resources Control Board 1988), and contains elements similar to the Alamo and New River Sedimentation/ Siltation TMDLs. Stakeholders who already have complied with the requirements of those TMDLs are not required to re-submit reports, workplans, or other information already submitted to the Regional Board. Stakeholders who are subject to multiple TMDLs are encouraged, but not required, to combine submissions so that a single report or workplan satisfies the requirements of all applicable TMDLs.

Imperial County Farm Bureau's Watershed Program
California Farm Bureau Federation and Imperial County Farm Bureau (ICFB) have taken a proactive approach to educate and encourage farmers to develop and implement self-determined MPs for sediment control through the Watershed Program. Regional Board staff fully supports this approach and will work closely with ICFB to: (a) track MP implementation and effectiveness, (b) develop and implement subwatershed water quality monitoring programs, and (c) provide regulatory guidance as needed.

ICFB is required to submit to the Regional Board a list of participants in its Watershed Program by September 28, 2003. It is expected that program participants cooperatively will develop subwatershed plans, further develop farm Water Quality Management Plans (WQMPs), report planned implementation actions and time-bound milestones to ICFB, and report completed implementation actions to ICFB. ICFB then will report to the Regional Board the planned implementation actions, time-bound milestones, and completed implementation actions on a subwatershed basis (not on a field-by-field or operator-by-operator basis). Figure 3 depicts ICFB and Regional Board interaction.

Figure 3: Interaction Between ICFB Watershed Program and Regional Water Quality Control Board (RWQCB)



Regarding the Watershed Program Plan, ICFB should:

a. By one month after Office of Administrative Law (OAL) approval of this TMDL**, issue letters to all potential program participants within the project area that are enrolled in the ICFB Watershed Program, informing them that the TMDL is being implemented and stating what is required of them.

b. By one month after OAL approval of this TMDL**, submit the ICFB Watershed Program Plan to the Regional Board. The Plan should: (1) identify measurable environmental and programmatic goals; (2) describe aggressive, reasonable milestones and timelines for development and implementation of TMDL outreach plans; (3) describe aggressive, reasonable milestones and timelines for development of subwatershed ("drainshed") plans; and (4) describe a commitment to develop and implement a tracking and reporting program.

c. By one month after OAL approval of this TMDL**, provide the Regional Board with a list of program participants, organized by subwatershed ("drainshed").

d. Submit semi-annual reports to the Regional Board's Executive Officer that describe: (1) progress of each subwatershed group, (2) planned or conducted technical assistance workshops, and (3) any other pertinent information.

** Implementation of this program has begun, via the Alamo River and New River TMDLs.

Regarding procedures for tracking and reporting, ICFB should:

a. By one month after OAL approval of this TMDL**, submit a plan to the Regional Board's Executive Officer describing tracking and reporting processes and procedures for: (1) implementation of MPs and other proven management practices, and (2) MP performance.

b. Implement the tracking and reporting procedures in accordance with the Implementation Plan.

c. Submit a yearly summary report to the Regional Board's Executive Officer by February 15th of each year.

If ICFB does not develop plans and mechanisms in accordance with the schedule set herein, the Regional Board will consider other regulatory approaches for individual dischargers.

Approved Self-Determined TMDL Watershed Programs

Farm landowners, renters/lessees, or operators/growers not participating in the ICFB Watershed Program must submit self-determined sediment control programs to the Regional Board by one month after OAL approval of this TMDL**. A sediment control program may be submitted by an individual operator/grower (Individual Program) or by a group of operators/growers (Group Program). Reported MP implementation is submitted to the Regional Board under penalty of perjury. The sediment control program must address the following:

1. Farm owner name, business address, mailing address, and phone number.
2. Farm operator/grower name, business address, mailing address, and phone number.
3. Problem assessment, including site conditions, crops, potential or current nonpoint source problems, problem severity, and problem frequency.
4. Goal statement, including measurable outcomes or products.
5. Existing and/or alternative sediment management practices, including technical/economic feasibility, and desired outcome.
6. Implementation timetable for Management Practices, measured in water quality improvement and/or implementation level.
7. Monitoring, including progress toward goals and management decision effectiveness.
8. Mechanism for reporting planned and completed implementation actions to the Regional Board. A group may provide a single monitoring and reporting plan as long as results are representative of the efficiency of the group's various control practices, in order to measure overall water quality improvements.

Additionally, a Group Program must provide information on a drain- or drainshed basis regarding which responsible parties are enrolled in the program.

At the request of responsible parties or groups furnishing a program, program portions that might disclose trade secrets shall not be made available for public inspection, but shall be made available to governmental agencies for use in determining further studies (California Water Code Section 13267(b)(2)). These program portions shall be available for use by the Regional Board or any state agency in judicial review or enforcement proceedings involving the person or group that furnished the report.

IID Drain Water Quality Improvement Plan

In 1994, the Regional Board's Executive Officer requested IID take "accelerated action to address degraded water quality conditions in Imperial Valley drainage ways." In response, IID submitted its Drain Water Quality Improvement Plan (DWQIP). IID implemented short-term demonstrations of MPs to reduce sediment runoff and implemented a monitoring program in agreement with Regional Board staff from 1996 through 1997. The DWQIP was suspended in 1999 upon recommendation of Regional Board staff so that the DWQIP could be revised to meet the needs of the TMDL process.

The Alamo River Sedimentation/ Siltation TMDL requires IID to submit a revised DWQIP by September 28, 2003 that includes proposed comprehensive water quality monitoring, sediment control measurements, monitoring time schedules, and implementation assurances. The New River Sedimentation/ Siltation TMDL requires IID to submit this information for the New River watershed by May 31, 2004. By <u>one month after OAL approval of this TMDL**</u>, IID must submit the same information for the Imperial Valley Drains watershed. Sediment-control measures must focus on operation and maintenance impacts (e.g., dredging, vegetation removal, blown tailwater discharge pipes). More specifically, IID must submit to the Regional Board a revised DWQIP with a proposed program to control and monitor water quality impacts caused by Imperial County river/ drain maintenance and dredging operations. The revised DWQIP is subject to Regional Board Executive Officer approval and must address, but need not be limited to, Items 1 and 2, below:

1. Drain Maintenance and Dredging Controls

   The revised DWQIP must consist of:

   - Control measures to ensure that drain maintenance operations do not cause TMDL exceedance. These measures must include: (a) seasonal restrictions to avoid impacts on sensitive resources during the nesting season, and (b) certified California Environmental Quality Act (CEQA) documents should the practices fall outside the scope of this TMDL.
   - Timelines for implementation of control practices.
   - Mechanisms to assess performance of control practices.

2. Drain Water Quality Monitoring Plan

   The revised DWQIP must consist of:

   - Water quality and habitat impacts caused by drain dredging operations.
   - Representative water column samples (taken from the last drain weir before the outfall) from all major drains and a statistically representative number from small drains tributary to the Salton Sea, for analyses of flow, TSS, turbidity, selenium, total organic carbon, nutrients, persistent pesticides (e.g., DDT and metabolites), pesticides applied by irrigation practices, pesticides used as pre-emergents and post-emergents by crop and season, and pesticides used for drain and channel weed control (e.g., diuron).
   - A statistically representative number of irrigation water locations, for TSS.
   - A statistically representative number of drains located sufficiently upstream of outfalls, to determine how much sediment/silt is reduced by field MPs.
   - Sediment impacts from storm events.

Also, no later than one month after OAL approval of this TMDL**, and on a semi-annual basis thereafter, IID must submit to the Regional Board the following information on agricultural dischargers within the District:

- Names and mailing addresses of all property owners engaged in irrigated agriculture within the IID service area, and property locations.
- Names and mailing addresses of all water account holders within the IID service area, and irrigated field locations.
- For each parcel within the IID service area, the parcel location, irrigation canals and gates serving the parcel, drop boxes draining the parcel, drains that these drop boxes empty into, and fields within each parcel.
- For each field within the IID service area, the parcel that each field is located within, area and location of each field within the parcel, irrigation canals and gates serving each field, drop boxes draining each field, and drains that these drop boxes empty into.

To the extent practical, the above information should be submitted in an electronic, tabular, and easily geo-referenced format.

Further, no later than 60 days following Regional Board Executive Officer approval of the revised DWQIP, the IID must submit to the Executive Officer for approval a Quality Assurance Project Plan (QAPP) for the revised DWQIP, prepared in accordance with *Requirements for Quality Assurance Project Plans for Environmental Data Operations*, EPA QA/R-5 (U.S. Environmental Protection Agency 2001). No later than 30 days following Regional Board Executive Officer approval of the QAPP, the IID must implement the QAPP and submit monthly, quarterly, and annual monitoring reports to the Executive Officer. Monthly reports are due on the 15th day of the month and must transmit the previous month's monitoring results, progress towards implementation of control practices, and performance of control practices. Quarterly reports are due on the 15th day of the month following the calendar's quarter and must transmit a quarterly summary of results for the previous three months. Annual reports are due on February 15 and must summarize the year's data, quality control reports, and any data trends.

NPS Recalcitrant Violators

Aggressive enforcement is necessary for responsible parties who fail to implement sediment control measures. To this end, the Regional Board may use any of the following:

- Implementation and enforcement of California Water Code (CWC) §13225, 13267, and 13268 to ensure that all responsible parties submit, in a prompt and complete manner, the Water Quality Management Plan defined above.

- Require submission of reports of waste discharge pursuant to CWC §13260.

- Adoption of waste discharge requirements, pursuant to CWC §13263, for any responsible party who fails to implement sediment controls.

- Adoption of enforcement orders pursuant to CWC §13304 against any responsible party who violates Regional Board waste discharge requirements and/or fails to implement sediment control measures to prevent and mitigate sediment pollution or threatened pollution of surface waters.

- Adoption of enforcement orders pursuant to CWC §13301 against any responsible party who violates Regional Board waste discharge requirements and/or prohibitions.

- Issuance of Administrative Civil Liability Complaints, pursuant to CWC §13261, 13264, or 13268 against any responsible party who fails to comply with Regional Board orders, prohibitions, and requests.

- Adoption of referrals of recalcitrant violators of Regional Board orders and prohibitions to the District Attorney or Attorney General for criminal prosecution or civil enforcement.

In assessing the compliance of any responsible party, Regional Board staff recommends that the Regional Board consider water quality results and the degree to which the responsible party is implementing sediment-control measures.

E. ADAPTIVE MANAGEMENT COMMITTEE

The Regional Board Executive Officer will establish an Adaptive Management Committee (AMC) comprised of stakeholder representatives and agencies. The AMC will meet at least semi-annually. Regional Board staff will provide AMC with formal results of water quality monitoring and tracking. AMC will evaluate overall MP implementation and performance, evaluate water quality improvements, and make appropriate recommendations for TMDL compliance and/or modification. IID and ICFB will have the opportunity to report their progress toward attainment of milestones set forth in this TMDL and in plans submitted by them pursuant to this Implementation Plan.

Proven MPs currently are available to address sediment loading. Therefore, this Implementation Plan does not require a schedule for development of management practices. However, the AMC and/or subwatershed groups can prioritize MPs for refinement and performance assessment, and can identify new management practices.

F. INTERIM NUMERIC TARGETS

The Regional Board's goal is attainment of TMDL allocations by the year 2013. The proposed implementation plan occurs in four phases. This schedule is synchronous with the implementation schedule for the New River Sedimentation/ Siltation TMDL. USEPA Guidance (U.S. Environmental Protection Agency 1991) allows for a phased approach for TMDL development and implementation when there is insufficient data. The numeric target, load allocations, waste load allocations, and margin of safety must be set when implementing a phased approach. However, these values may be modified based on new data. In the meantime, dischargers can implement procedures to reduce pollutant loadings. This TMDL requires additional data to determine load reduction adequacy and to better determine assimilative capacities and allocations. Time-bound interim numeric targets are shown in Table 14.

Table 14: Interim Numeric Targets

Phase	Time Period	Estimated Reduction*	Interim Target (mg/L)
Phase 1	2004 (Year 1)	20%	334
Phase 2	2005 through 2007 (Years 2 – 4)	25%	251
Phase 3	2008 through 2010 (Years 5 – 7)	15%	213
Phase 4	2011 through 2013 (Years 8 – 10)	6%	200

* Percent reductions indicate the reduction required in TSS at the beginning of each phase, starting with the current (2002) average concentration of 418 mg/L.

G. MONITORING AND TRACKING PROGRAM

It is important to track TMDL implementation, monitor water quality progress, and modify TMDLs and Implementation Plans as necessary because the Regional Board wants to:

- Address uncertainty that may have existed during TMDL development
- Oversee TMDL implementation to ensure that implementation is occurring
- Ensure TMDL effectiveness, given watershed changes that may have occurred after TMDL development

The Regional Board will conduct the TMDL Monitoring and Tracking Program pursuant to a Quality Assurance Project Plan (QAPP). The QAPP will be developed by Regional Board staff and will be ready for implementation within one month after Office of Administrative Law (OAL) approval of this TMDL[**]. Regional Board staff will perform two types of monitoring: (1) water quality monitoring, and (2) implementation tracking. Both are described below.

Water Quality Monitoring

The proposed implementation plan calls for water quality monitoring to: (a) ensure that load allocations are met, (b) further characterize MP effectiveness in relation to local Imperial Valley conditions, and (c) revise the TMDL as needed. Specifically, monitoring program objectives include:

- assessment of water quality objectives attainment
- verification of discharge sources
- calibration or modification of selected models (if any)
- refinement of pollutant mass balances
- evaluation of point and nonpoint source control implementation and effectiveness
- evaluation of in-stream water quality
- evaluation of water quality temporal and spatial trends

** Implementation of this program has begun, via the Alamo River and New River TMDLs.

The following parameters will be sampled, contingent on funding. Data sources may be outside of the Regional Board. Frequency is in brackets.

- Flow [Quarterly]
- Field turbidity [Monthly]
- Lab turbidity (EPA Method No. 180.1) [Monthly]
- Total Suspended Solids (EPA Method No. 160.2) [Monthly]
- Total DDT and DDT metabolites (EPA Method No. 8081) [Quarterly]

Implementation Tracking

Regional Board staff will develop a plan to track TMDL implementation, within one month after Office of Administrative Law (OAL) approval of this TMDL[**]. Objectives are to:

- Assess, track, and account for practices already in place
- Measure milestone attainment
- Report progress toward NPS water quality control implementation, in accordance with the State's Nonpoint Source Management Plan

I. MEASURES OF SUCCESS, AND FAILURE SCENARIOS

Measures of Success

The primary measure of success for TMDL implementation is attainment of interim numeric targets and corresponding interim load allocations, with attainment of final TMDL load allocations. Another measure of success may be the number of responsible parties that implement sediment-control measures.

Failure Scenarios

Two failure scenarios exist regarding TMDL implementation. The first is failing to meet water quality improvement goals (interim numeric targets and corresponding load allocations) coupled with *achievement* of implementation milestones. If this scenario materializes, MPs and interim targets will be re-evaluated and adjusted. The second failure scenario involves failure to meet water quality improvement goals (interim numeric targets and corresponding load allocations) coupled with *failure* to achieve implementation milestones**.** If this scenario materializes, the Regional Board shall consider more stringent regulatory mechanisms.

H. TMDL REVIEW SCHEDULE

Annual Reports

Regional Board staff shall present yearly reports to the Regional Board describing progress toward milestone attainment. Reports will assess:

- Water quality improvement (in terms of total suspended sediments, total sediment loads, Total DDT, and DDT metabolites).
- MP implementation trends and effectiveness.

- Whether milestones were met on time or at all. If milestones were not met, the reports will discuss reasons and make recommendations.
- Level of compliance with measures and timelines agreed to in Program Plans and Drainshed Plans.

Triennial Review
The first TMDL review is scheduled to conclude three years after TMDL approval to provide adequate time for implementation and data collection. Subsequent reviews will be conducted concurrently with the Basin Plan Triennial Review.

The review will evaluate effectiveness of reducing sediment/ silt in drains. Interim numeric targets will be analyzed in relation to actual reductions and level of MP implementation. This analysis will be used to measure progress in addressing the water quality impairment.

The TMDL review schedule is shown in Table 15.

Table 15: TMDL Review Schedule*

Activity	Date
Approval	2004
Begin First Review	August 2004
End Review (Regional Board Public Hearing)	April 2005
Submit Administrative Record to State Water Resources Control Board (State Board)	May 2005
Begin Second Review	July 2006
End Review (Regional Board Public Hearing)	June 2007
Submit Administrative Record to State Board	July 2007
Begin Third Review	July 2009
End Review (Regional Board Public Hearing)	June 2010
Submit Administrative Record to State Board	July 2010
Etc.	

* Dates are contingent upon Regional Board adoption and State Board approval.

Regional Board staff proposes that the Regional Board hold public hearings at least every three years to review sediment-control progress. At these hearings, it is proposed that the Regional Board consider:

- monitoring results
- progress toward milestone attainment
- MP implementation trends

- modification and/or addition of management practices for sediment discharge control
- revision of TMDL components and/or development of site-specific water quality objectives

PROPOSED AMENDMENT

The Proposed Basin Plan Amendment:

- Updates references to the State's Nonpoint Source Management Plan
- Includes Regional Nonpoint Source Management Plan elements
- Deletes dated information that is no longer accurate
- Establishes a numeric target of 200 milligrams per liter of total suspended solids
- Adds a section for this proposed TMDL that:

    - Summarizes TMDL elements, including the Problem Statement, Numeric Target, Source Analysis, Margin of Safety, Seasonal Variations and Critical Conditions, Loading Capacity, and Load Allocations and Wasteload Allocations
    - Establishes interim numeric targets
    - Designates responsible parties and management actions
    - Lists recommended Management Practices (MPs), with estimated implementation costs and financing sources
    - Describes recommended actions for cooperating agencies
    - Describes TMDL compliance monitoring and enforcement activities
    - Describes Regional Board water quality monitoring and implementation tracking activities to assess TMDL implementation
    - Describes public reporting activities
    - Describes the Regional Board review process

CONDITIONAL PROHIBITION

The Proposed Basin Plan Amendment includes a conditional prohibition of sediment/ silt discharge for Imperial Valley. This includes the Alamo River, New River, Imperial Valley Drains, and their tributaries. Sediment/ silt from irrigated lands currently is discharged in amounts that violate water quality standards. The intent of the conditional prohibition is to control sediment/ silt so that water quality standards are no longer being violated.

The conditional prohibition will go into effect three months after OAL approval of this sedimentation/ siltation TMDL. Direct or indirect discharge of sediment will be prohibited unless the discharger :

1. Is in compliance with applicable Sedimentation/ Siltation TMDL(s), including being in good standing with the ICFB Watershed Program or having a Drain Water Quality Monitoring Plan (DWQMP) approved by the Regional Board's Executive Officer; or

2. Has a monitoring program approved by the Regional Board's Executive Officer; or

3. Is covered by Waste Discharge Requirements (WDRs) or a Waiver of WDRs.

TMDL compliance groups have formed to address issues regarding wastewater discharge from irrigated lands to waters of the state. The Regional Board does not require individual dischargers to join these groups. However, individual dischargers who choose not to participate in these groups must file a Report of Waste Discharge for general or individual Waste Discharge Requirements.

ECONOMIC IMPACTS

A. ECONOMIC IMPACT ASSESSMENT

The State Board Economics and Effectiveness Unit prepared an Economic Impact Assessment that evaluated costs of implementing Management Practices (MPs) that reduce sediment/ silt. Implementation of this TMDL probably will increase total production costs by less than 1% for field crops and vegetables. For non-vegetable row-crops, sediment retention costs represent about 2% of total production costs.

The estimated costs of sediment/ silt reduction ranged from a high of just under $200,000 to a low of over $22,000 for the 10,463 acres that are drained by the subject drains. The high-cost scenario was based on installation of sediment ponds or synthetic fiber strips. The low-cost scenario was based on installation of grass strips. Average per acre costs ranged from just under $20 to over $2 per acre.

B. FEDERAL TECHNICAL AND FINANCIAL ASSISTANCE

Natural Resources Conservation Service
The U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) offers landowners financial, technical, and educational assistance to implement conservation practices on privately-owned land. These programs include:

Environmental Quality Incentives Program -- offers financial, educational, and technical help to implement MPs such as manure management systems, pest management, and erosion control, to improve environment health. Cost-sharing may pay up to 75% of costs of certain conservation practices.

National Conservation Buffer Initiative -- created to help landowners establish conservation buffers, such as riparian areas along rivers, streams, and wetlands.

Clean Water Act Section 319(h)
Federal NPS water quality implementation grants are available each year on a competitive basis. These grants range from $25,000 to $350,000 and require a 40% non-federal match. The Regional Board administers these grants.

Clean Water Act Section 205(j)
Federal water quality planning grants are available each year on a competitive basis. These grants range from $25,000 to $120,000 and require a 25% non-federal match. The Regional Board administers these grants.

C. STATE TECHNICAL ASSISTANCE

University of California Cooperative Extension
U.C. Cooperative Extension offers technical assistance regarding MPs and erosion control.

D. POTENTIAL FUNDING SOURCES

Potential funding sources include:

- Private financing by individual sources
- Bond indebtedness or loans from government institutions
- Surcharges on water deliveries to lands contributing to sediment pollution
- Taxes and fees levied by the IID for drainage management
- State and/or federal grants and low-interest loans
- Single-purpose appropriations from federal and/or state legislative bodies

REFERENCES

References Cited

Bali, Khaled. 2000. Personal communication with Mr. Khaled Bali of the University of California Cooperative Extension and Jose Cortez of the California Regional Water Quality Control Board, Colorado River Basin Region.

Bennett, J. 1998. Biological Effects of Selenium and Other Contaminants Associated with Irrigation Drainage in the Salton Sea Area, California 1992-1994: U.S. Department of Interior National Irrigation Water Quality Program Information Report No. 4. U.S. Department of the Interior, National Irrigation Water Quality Program, Washington, D.C.

California Department of Food and Agriculture. 1985. Agricultural Sources of DDT Residues in California's Environment. California Department of Food and Agriculture, Environmental Hazards Assessment Program, Sacramento, CA

California Department of Water Resources. 1997-2002. Division of Flood Management, Monthly Rainfall Data for Imperial Valley, January 1997 to December 2002. Available on-line at http://cdec.water.ca.gov/cgi-progs/queryMonthly?

California Regional Water Quality Control Board. As amended to date. Water Quality Control Plan: Colorado River Basin – Region 7. California Regional Water Quality Control Board, Colorado River Basin Region. Palm Desert, CA

Eccles, L.A. 1979. Pesticide Residues in Agricultural Drains, Southeastern Desert Area, California: U.S. Geological Survey Water-Resources Investigations 79-16. U.S. Geological Survey, Menlo Park, CA

European Inland Fisheries Advisory Committee. 1965. Water Quality Criteria for European Freshwater Fish, Report on Finely Divided Solids and Inland Fishes: International Journal of Air and Water Pollution, Vol. 9, pp. 151-168. Permagon Press, Great Britain.

Genium Publishing Corporation. 1999. Genium's Handbook of Safety, Health, and Environmental Data for Common Hazardous Substances. Genium Publishing Corporation. Schenectady, NY

Imperial Irrigation District. 1998. IID Background – Facts and Figures. http://www.iid.com/aboutiid/iidbackground-facts.html

Imperial Irrigation District. 2003. Daily irrigation delivery and monthly drain flow from January 1997 to December 2002 for all Imperial Valley drains. Database on CD-ROM disk.

Imperial Valley Farm Bureau. 2003. TMDL Voluntary Compliance Program. Imperial Valley Farm Bureau, El Centro, CA. http://www.ivtmdl.com/

Jensen, M.E. and I.A. Walter. 1997. Assessment of 1986-1997 Water Use by the Imperial Irrigation District Using Water Balance and Cropping Data. Special Report Prepared for the U.S. Bureau of Reclamation. Boulder City, NV

Jones & Stokes Associates. 1996. List of Agricultural Best Management Practices for the Imperial Irrigation District. Jones & Stokes Associates, Sacramento, CA

Kalin, Al. 2003. Reducing Silt in Your Irrigation Drain Water. A Handbook on Best Management Practices for the Imperial County Silt TMDLs. Imperial County Farm Bureau Voluntary TMDL Compliance Program, April 9, 2003, 4th Revision. Imperial County Farm Bureau, Imperial, CA

Kaloyanova, F.P. and M.A. El Batawi. 1991. Human Toxicology of Pesticides. CRC Press, Boca Raton, FL

Kennedy, J.B., and A.M. Neville. 1986. Basic Statistical Methods for Engineers and Scientists, Third Edition. Harper and Row Publishers, New York, NY

Knell, Steve. 2000. Personal communication with Mr. Steve Knell of the Imperial Irrigation District and Jose Cortez of the California Regional Water Quality Control Board, Colorado River Basin Region. March 15, 2000.

LeBlanc, L., R. A. Schroeder, J. L. Orlando, and K. M. Kuivila. 2003. Distribution of Pesticides Between Water and Sediments in the Salton Sea Basin, California, 2001-2002. Preliminary Report for Review: subject to revision. U.S. Geological Survey, Sacramento, CA

MapQuest. 2003. Database search for Calipatria, California. Available online at http://www.mapquest.com/maps/map.adp?country=US&addtohistory=&address=&city=calipatria&state=ca&zipcode=&homesubmit=Get+Map.

Mora, M.A., D.W. Anderson, and M.E. Mount. 1987. Seasonal variation of body condition and organochlorines in wild ducks from California and Mexico: Journal of Wildlife Management, v. 5, no. 1, p. 132-140

Natural Resources Conservation Service. 1996. Field Office Technical Guide, Section IV, Conservation Practices. U.S. Department of Agriculture, Davis, CA

Ohlendorf, H.M. and M.R. Miller. 1984. Organochloride contaminants in California waterfowl: Journal of Wildlife Management, v. 48, no. 3, p. 867-877

Setmire, J.G., J.C. Wolfe, and R.K. Stroud. 1990. Reconnaissance Investigation of Water Quality, Bottom Sediment, and Biota Associated with Irrigation Drainage in the Salton Sea Area, California, 1986-87: U.S. Geological Survey Water-Resources Investigations Report 89-4102. U.S. Geological Survey, Sacramento, CA

Setmire, J.G., R.A. Schroeder, J.N. Densmore, S.L. Goodbred, D.J. Audet, and W.R. Radke. 1993. Detailed Study of Water Quality, Bottom Sediment, and Biota Associated with Irrigation Drainage in the Salton Sea Area, California, 1988-90: U.S. Geological Survey Water-Resources Investigations Report 93-4014. U.S. Geological Survey, Sacramento, CA

State Water Resources Control Board. 1978-1995. California Toxic Substances Monitoring Program. State Water Resources Control Board, Sacramento, CA

State Water Resources Control Board. 1988. California Nonpoint Source Management Plan. State Water Resources Control Board, Sacramento, CA

The Redlands Institute. 2003. Regional Water Quality Control Board GIS Initiative. University of Redlands, Redlands, CA

United States Environmental Protection Agency. 1973. Water Quality Criteria 1972. EPA-R3-73-033-March 1973. A Report of the Committee on Water Quality Criteria, Environmental Studies Board, National Academy of Sciences, National Academy of Engineering. U.S. Government Printing Office, Washington D.C., 1972.

United States Environmental Protection Agency. 1980. Ambient Water Quality Criteria for DDT: U.S. Environmental Protection Agency 440/5-80-038. U.S. Environmental Protection Agency, Washington, D.C.

United States Environmental Protection Agency. 1986. Quality Criteria for Water. U.S. Environmental Protection Agency, Washington, D.C.

United States Environmental Protection Agency. 1989. Toxaphene Fact Sheet. http://mail.odsnet.com/TRIFacts/281.html

United States Environmental Protection Agency. 1991. Guidance for Water Quality-Based Decisions: The TMDL Process. U.S. Environmental Protection Agency, Washington, D.C.

United States Environmental Protection Agency. 1999. Protocol for Developing Sediment TMDLs. E.P.A. 841-B-99-004. Office of Water (4503F), U.S. Environmental Protection Agency, Washington, D.C. 132pp

United States Environmental Protection Agency. 2001. EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5. U.S. Environmental Protection Agency, Washington, D.C.

United States Environmental Protection Agency. 2002. National Recommended Water Quality Criteria: 2002. EPA-822-R-02-047. U.S. Environmental Protection Agency, Washington, D.C.

Ware, G.W. 1991. Fundamentals of Pesticides. Thompson Publications, Fresno, CA

Waters, T.F. 1995. Sediment in Streams, Sources, Biological Effects and Control. American Fisheries Society, Bethesda, MD

Wood, Paul J. and Patrick D. Armitage. 1997. Biological Effects of Fine Sediment in the Lotic Environment., Environmental Management Vol. 21, No.2, pp 203-217., Springer-Verlag New York Inc., NY

Zimmerman, R.P. 1981. Soil Conservation Service Soil Survey of Imperial County, California, Imperial Valley Area. United States Department of Agriculture